

Places. Excavation of the Brandy Station graves also yielded data on late 19th-century burial practices that, with the results of other bioarcheological studies, can enhance understanding of American social history of the past century.

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Forensic Anthropology and the FBI

Cadaver dog trained to detect decomposing human remains. Photo by the author.

The inclusion of forensic anthropology in criminal investigations involving the Federal Bureau of Investigation can be traced back to the early development of American physical anthropology. Czech-born Aleš Hrdlička (1869-1943) is widely recognized as the founder of American physical anthropology. Hrdlička spent most of his career at the Smithsonian Institution, located near the FBI headquarters in Washington, DC. Although Hrdlička is not known for his work on the forensic applications of physical anthropology, he gradually assembled the comparative collections and established the methodology that made this endeavor possible (Stewart 1982). Smithsonian records show that Hrdlička had some contact with FBI officials, advising them on cases within his expertise.



In 1939, the *FBI Law Enforcement Bulletin* published Wilton Krogman's article on human identification, a publication that raised awareness in the law enforcement community of the potential contribution of forensic anthropology to medico-legal investigation.

The relationship between the FBI and the Smithsonian Institution with regard to forensic anthropology solidified when Hrdlička's student, and his Smithsonian replacement, T.D. Stewart, began consulting for the FBI in 1942. Stewart not only analyzed skeletons for the FBI and others for the next 20 years, but added to the national collections and, even more importantly, published regularly on forensic anthropology topics (Stewart 1979). During this period, the involvement of physical anthropologists in forensic science grew steadily.

In 1962, J. Lawrence Angel (1915–1986) joined the Smithsonian staff and assumed responsibility for consultation with the FBI (Ubelaker 1990). Angel continued assisting the FBI until 1977 when he decided to take a sabbatical and I took over the work. During this period, he reported on approximately 368 forensic cases, many for the FBI. The latter half of Angel's 15 years of FBI service also witnessed important organizational advancements in the field of forensic anthropology. Key developments include the formation of the Physical Anthropology section of the American Academy of Forensic Sciences in 1972 and the certification program of the American Board of Forensic Anthropology in 1978. Angel also initiated a training program in forensic anthropology at the Smithsonian that provided educational exposure for forensic pathologists and others with regard to his analytical methodologies.

From 1977 until the present, I have continued the Smithsonian tradition of assisting the FBI with those cases relating to forensic anthropology. I have reported on approximately 595 cases, most of them submitted through the FBI laboratory. Together with Smithsonian colleague Douglas Owsley, we provide anthropological input into medico-legal problems relating to our expertise. Smithsonian training is available through individual internships, lecture programs, and an annual course that, in recent years, we alternate hosting at the Smithsonian and in Europe. Additional lectures on forensic anthropology are sometimes available at the FBI's training center in Quantico, Virginia.

When FBI agents or other law enforcement officials bring their boxes of osteological remains to us at the Smithsonian, they recognize that we have the expertise and the necessary comparative collections to help resolve identification problems. The Smithsonian's process begins with documentation of the chain of evidence and then may proceed to determining if the remains are human, age at death, sex, living stature, time since death, what happened to the remains after death but before discovery (taphonomic change), any observations that might contribute to identification and finally, an assessment of evidence for foul play. At times, the Smithsonian's forensic anthropologists also utilize their archeological skills to assist law enforcement in the on-site recovery of evidence.

To best illustrate how forensic anthropology can contribute to the investigative process, the following fictitious forensic case is presented. In a state prison, an inmate tells another inmate that 10 years earlier, he had left a bar with a young woman. During an ensuing argument, the woman pulled a knife on him. The inmate reported that, in defense, he pulled his own knife. When the

woman lunged at him, he stabbed her once in the chest and she died. Suspecting that no one would believe that his act had been in self-defense because of his previous record of assault, he took the body to an abandoned farmyard and hid the remains in some brush. According to his story, two days later he returned and buried the remains in a shallow grave that he dug with a shovel that he found there.

His casual confession made its way to the prison warden who notified the police. The inmate was able to take the police to the general area where the burial had supposedly taken place, but he could not remember the exact site. The police notified the local medical examiner and together they decided to ask the FBI and the Smithsonian Institution for assistance. Topographic analysis revealed four locations of possible burial within the general area: two slight depressions in the ground surface, an area of unusual plant growth, and a slight mound of earth. The FBI conducted a detailed analysis of the area using a combination of metal detectors, ground penetrating radar, and proton magnetometers. The remote sensing determined that the two slight depressions appeared to represent old collapsed drainfields. The slight mound of earth showed evidence of subsurface disturbance, as did the area of unusual plant growth.

A team of cadaver dogs, specifically trained to smell human remains, were brought on site. The dogs delivered no strong signals, but their handler thought they gave some weak signs of interest near the mound and the area of plant growth.

A decision was made to archeologically test the two areas of greatest interest, the mound of earth and the area of plant growth. The area was mapped and a standard grid was laid out over the area of plant growth. The excavation team carefully removed the soil with trowels and brushes, a layer at a time. Eventually they discovered that the shape of the original pit and its contents did not represent a burial, but rather the remnants of a former outhouse.

The excavation process was repeated in the area of the earthen mound. Excavation revealed soil patterns suggesting an oval-shaped pit had been dug measuring about six feet in length. In the bottom of the pit, the archeologists found an articulated skeleton.

After thorough documentation of the pit and its contents, the evidence was removed and processed. Small remnants of clothing were recognized and studied by the appropriate specialist. The remains themselves were sent to FBI headquarters in Washington, DC. where personnel in the Hairs and Fibers Unit carefully screened them for trace evidence. Finally, the osteological

remains were boxed up and a FBI agent carried them across Pennsylvania and Constitution Avenues to the Smithsonian's National Museum of Natural History. In the Anthropology Department, they were logged in. Analysis began with a careful inventory. A nearly complete human skeleton was present along with several animal bones. The bones were well-preserved, although some showed evidence of carnivore chewing. Apparently, dogs had discovered the body during the two days between death and burial.

The size of the bones and the state of dental formation and eruption indicated that the person represented was not a juvenile. Observable epiphyses on the long bones were united, but the epiphysis on the iliac crest of the pelvis showed evidence of recent union. This and other indicators suggested the individual was likely between 20 and 25 years old at the time of death (Ubelaker 1989). Female sex was suggested by the appearance of the pelvis, skull, and other bones.

Various features of the face indicated a likely European ancestry (socially classified as "White"). Such ancestry was also indicated by a mathematical computation utilizing measurements of the skull. The procedures for this calculation had been developed through an analysis of measurements recorded from identified forensic cases, which are stored in a computerized databank (Jantz and Moore Jansen 1988).

Measurements of the recovered long bones suggested a living stature of about 5'-6", using formulae developed for White females.

The remains were completely skeletonized although well-preserved and were otherwise consistent with a time since death of about 10 years.

The teeth displayed numerous fillings. In addition, there was evidence of antemortem bone fractures in several ribs and the bones of the face. These fractures were completely healed and showed evidence of advanced bone response, suggesting they had occurred at least two years before death.

Evidence for perimortem (at or about the time of death) trauma consisted of incisions in four of the upper ribs on the anterior right side. The alterations clearly represented sharp force trauma and placement of the ribs in anatomical order indicated that at least four separate insertions of a knife or knife-like instrument had taken place.

The police strongly suspected that the remains were those of a girl who had been missing from the area for about 10 years. She was about 5'-6" tall and of European ancestry. However, her age was known to be 12 years and she had no medical history of broken bones. The Smithsonian's analysis suggested that the missing

person was not represented by the recovered remains.

To assist the investigation, Smithsonian anthropologists collaborated with FBI artists to produce a facial reproduction (Ubelaker and O'Donnell 1992). Eraser-type markers were placed on the skull to indicate the depth of the soft tissue. Using a special computer at the FBI, the skull image was digitized and gradually the soft parts were recreated until the anthropologists and artists agreed that a reasonable likeness had been achieved. The facial image was printed out and sent to media in the area. Two days later, a woman called police indicating that she had seen the image on television and it looked a lot like her cousin whom she had not seen in 10 years. The woman would have been 23 years old, about five feet six inches tall, and of European ancestry. The woman added that her cousin had been in a terrible car accident about 13 years ago and had broken bones in her face and chest.

Unfortunately, police were unable to locate the woman's medical or dental records but they did find several photographs taken of her shortly before she disappeared. Using much of the same FBI equipment utilized in the facial reproduction procedure, Smithsonian anthropologists and FBI artists compared the image of the recovered skull with the photographic evidence (Ubelaker, *et al.*, 1992). Both images were properly sized and oriented and then digitized. When the two superimposed images appeared simultaneously on the computer monitor, each anatomical detail on the photograph aligned and matched the corresponding landmark on the skull. The match was impressive. The Smithsonian's anthropologist concluded that it was highly probable that the photograph and the skull originated from the same individual, although the computerized comparison did not allow a positive identification to be made.

Medical and dental records of the missing woman could not be found. However, the family remembered that she had kept her baby teeth when they had fallen out. DNA comparative analysis of those baby teeth and the bone samples confirmed that the recovered remains were those of the missing person.

Eventually, the case went to trial. Testimony was needed from the Smithsonian anthropologist not only to report on the recovery, analysis, and identification of the remains, but also on the evidence for trauma. The finding of evidence for multiple sharp force trauma contradicted the confession that a single knife wound had been inflicted. Rigorous cross-examination by the defense attorney attempted to suggest that the anthropologist had confused evidence of carnivore chewing with that of sharp force trauma. The jury

believed the anthropologist because of his extensive research experience and knowledge of such alterations on the human skeleton and because of the clarity of his testimony.

The above theoretical case illustrates the complexity of forensic anthropology involvement in the investigative process. Forensic anthropologists contribute not only to the recovery and analysis of relatively complete skeletons, but also to that of small fragments and multiple individuals resulting from mass disasters. In 1996, there were about 46 board-certified forensic anthropologists in the United States and Canada. Since this expertise is available to police departments throughout North America, increasingly cases sent to the FBI-Smithsonian investigative team are the most difficult, involving fragmentation, extensive trauma, or those requiring specialized analysis such as the facial reproduction or photographic superimposition techniques discussed in the example above.

Forensic anthropology has become a recognized, regular contributor to the medical-legal investigation of death. The tradition of collaboration between the FBI and the Smithsonian that began over a half-century ago continues productively today.

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New Publication

In Remembrance: Archaeology and Death.

David A. Poirier and Nicholas F. Bellantoni, editors. Greenwood Publishing Group, Inc., 88 Post Road West, Westport, CT 06881; Price: \$59.95; cloth; 264 pp; ISBN: 0-89789-419-7; Order Code: H419; Publication Date: 01/30/97.

In recent years, federal and state governments have recognized their responsibility for the protection of unmarked ancient burial grounds that may be threatened by modern land-use activities and natural disasters. The editors of this new book have compiled case studies that reflect effective answers to removal, analysis, and reburial of human remains by archeologists. Each study provides fascinating research from the excavation of historic cemeteries, which has added considerable knowledge to our understanding of factors relating to health, disease,

and trauma, and the social histories of the diverse human communities occupying North America during the last three centuries.

The Introduction highlights recent examples of the way osteological analysis of burials contributes to our knowledge of past histories. Part I examines several socially-disenfranchised groups that are underrepresented in historic records. These analyses demonstrate how archeological and anthropological research can contribute to a better understanding of cultural conditions and life ways of important social groups. Part II consists of articles that illustrate where past and recent traumas and desecration have affected human burials. Part III represents the only technical section, providing a resource guide on professional standards in conducting documentary research as well as field work in the location and excavation of historic burials.